

## METHOD AND APPARATUS FOR A PARALLEL CORRELATOR AND APPLICATIONS THEREOF

### ABSTRACT OF THE DISCLOSURE

A fast correlator transform (FCT) algorithm and methods and systems for implementing same, correlate an encoded data word ( $X_0$ - $X_{M-1}$ ) with encoding coefficients ( $C_0$ - $C_{M-1}$ ), wherein each of ( $X_0$ - $X_{M-1}$ ) is represented by one or more bits and each said coefficient is represented by one or more bits, wherein each coefficient has  $k$  possible states, and wherein  $M$  is greater than 1. In accordance with the invention,  $X_0$  is multiplied by each state ( $C_{0(0)}$  through  $C_{0(k-1)}$ ) of the coefficient  $C_0$ , thereby generating results  $X_0C_{0(0)}$  through  $X_0C_{0(k-1)}$ . This is repeating for data bits ( $X_1$ - $X_{M-1}$ ) and corresponding coefficients ( $C_1$ - $C_{M-1}$ ), respectively. The results are grouped into  $N$  groups. Members of each of the  $N$  groups are added to one another, thereby generating a first layer of correlation results. The first layer of results is grouped and the members of each group are summed with one another to generate a second layer of results. This process is repeated as necessary until a final layer of results is generated. The final layer of results includes a separate correlation output for each possible state of the complete set of coefficients ( $C_0$ - $C_{M-1}$ ). The final layer of results is compared to identify a most likely code encoded on said data word. In an embodiment, the summations are pruned to exclude summations that would result in invalid combinations of the encoding coefficients ( $C_0$ - $C_{M-1}$ ). In an embodiment, substantially the same hardware is utilized for processing in-phase and quadrature phase components of the data word ( $X_0$ - $X_{M-1}$ ). In an embodiment, the coefficients ( $C_0$ - $C_{M-1}$ ) represent real numbers. In an alternative embodiment, the coefficients ( $C_0$ - $C_{M-1}$ ) represent complex numbers. In an embodiment, the coefficients ( $C_0$ - $C_{M-1}$ ) are represented with a single bit. Alternatively, the coefficients ( $C_0$ - $C_{M-1}$ ) are represented with multiple bits (e.g., magnitude). In an embodiment, the coefficients ( $C_0$ - $C_{M-1}$ ) represent a cyclic code keying ("CCK") code set substantially in accordance with IEEE 802.11 WLAN standard.